U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-291 245

# Environmental Assessment of Polychlorinated Biphenyls (PCBs) Near New Bedford, MA. Municipal Landfill

Environmental Science and Engineering, Inc, Gainesville, FL

Prepared for

Environmental Protection Agency, Washington, DC Office of Toxic Substances

26 May 78

**TECHNICAL REPORT DATA**
*(Please read Instructions on the reverse before completing)*

| 1. REPORT NO. | 2. | 3. RECIPIENT'S ACCESSION NO. |
|---|---|---|
| 560/6-78-006 | | PB291245 |

| 4. TITLE AND SUBTITLE | 5. REPORT DATE |
|---|---|
| Environmental Assessment of Polychlorinated Biphenyls (PCBs)Near New Bedford, MA Municipal Landfill | May 26, 1978 |
| | 6. PERFORMING ORGANIZATION CODE |
| 7. AUTHOR(S) | 8. PERFORMING ORGANIZATION REPORT NO. |
| Charles L. Stratton, Karen L. Tuttle, J. Mark Allan | |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS | 10. PROGRAM ELEMENT NO. |
| Environmental Science & Engineering, Inc.<br>P.O. Box 13454, University Station<br>Gainesville, FL 32604 | 11. CONTRACT/GRANT NO.<br>68-01-3248 |
| 12. SPONSORING AGENCY NAME AND ADDRESS | 13. TYPE OF REPORT AND PERIOD COVERED |
| Environmental Protection Agency<br>Office of Toxic Substances<br>Washington, DC 20460 | 5/77-5/78 Task |
| | 14. SPONSORING AGENCY CODE |

15. SUPPLEMENTARY NOTES

16. ABSTRACT

A survey was conducted to assess the extent of transport of polychlorinated biphenyls (PCBs) from the New Bedford, MA municipal landfill. This landfill has been used for the disposal of PCB waste materials for many years. It is located in a wetland area. There is evidence of transport of PCBs in the shallow ground water to the northwest of the landfill, but the extent of transport is relatively minor, being confined to near surface waters very near the landfill. Drinking waters are unaffected. Aquatic and terrestrial organisms in the vicinity are accumulating some PCB; however, levels of contamination are not excessively high. There is evidence to indicate airborne transport may be a principal mode of movement of PCB from the landfill during the warm months. At one time, in excess of 1.0 ug/$m^3$ of PCB was detected in the ambient air over this landfill.

17. KEY WORDS AND DOCUMENT ANALYSIS

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Polychlorinated Biphenyls, PCBs, solid waste landfill, Aroclor 1016, Aroclor 1242, Aroclor 1254 | environmental contamination, air pollution | |

| 18. DISTRIBUTION STATEMENT | 19. SECURITY CLASS (This Report) | 21. NO. OF PAGES |
|---|---|---|
| unlimited | unclassified | 48 |
| | 20. SECURITY CLASS (This page) | 22. PRICE |
| | unclassified | A03-A01 |

EPA Form 2220-1 (9-73)

PB 291245

560/6-78-006

# ENVIRONMENTAL ASSESSMENT OF POLYCHLORINATED BIPHENYLS (PCBs) NEAR NEW BEDFORD, MASSACHUSETTS MUNICIPAL LANDFILL

May 1978

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF TOXIC SUBSTANCES
WASHINGTON, D.C. 20460

DISCLAIMER

This report has been reviewed by the Office of Toxic Substances, U.S. Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

# ENVIRONMENTAL ASSESSMENT OF POLYCHLORINATED BIPHENYLS (PCBs)

# NEAR NEW BEDFORD, MA

# MUNICIPAL LANDFILL

Final Task Report
Research Request No. 4
Contract No. 68-01-3248

by

Charles L. Stratton, Karen L. Tuttle, and J. Mark Allan

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
P. O. Box 13454, University Station
Gainesville, Florida 32604

Project Officer
Thomas Kopp

OFFICE OF TOXIC SUBSTANCES
ENVIRONMENTAL PROTECTION AGENCY
Washington, D.C. 20460

May, 1978

ia

CONTENTS


| | Page |
|---|---|
| Figures | ii |
| Tables | iii |
| Acknowledgement | iv |
| 1. INTRODUCTION | 1 |
| 2. DESCRIPTION OF THE SITE | 3 |
| 3. FIELD SURVEY AND SAMPLING | 6 |
| Ground Waters | 6 |
| Soils | 10 |
| Drinking Water | 10 |
| Surface Water and Sediments | 10 |
| Vegetation | 14 |
| Aquatic Biota | 14 |
| Terrestrial Biota | 14 |
| Air | 16 |
| 4. ANALYTICAL RESULTS AND DISCUSSION | 17 |
| Ground Waters | 17 |
| Soil Borings | 18 |
| Stream Sediments | 24 |
| Surface Water | 24 |
| Biota | 24 |
| Ambient Air | 27 |
| 5. CONCLUSIONS | 36 |

LIST OF FIGURES


| | | Page |
|---|---|---|
| Figure 1 | New Bedford Municipal Landfill and Surroundings | 4 |
| Figure 2 | Possible Avenues for PCB to Re-enter the Environment from Landfill Disposal Site | 7 |
| Figure 3 | Groundwater Sampling Points | 8 |
| Figure 4 | Stream Sampling Stations | 11 |
| Figure 5 | Marsh Sampling Stations | 12 |
| Figure 6 | Terrestrial Trap Locations | 15 |
| Figure 7 | Chromatogram of Shallow Groundwater Sample from Test Well No. 9 | 19 |
| Figure 8 | Chromatogram of (a) Aroclor 1016 Standard and (b) Aroclor 1242 Standard | 20 |
| Figure 9 | Chromatogram of Aroclor 1254 Standard | 21 |
| Figure 10 | Chromatogram of Soil Core (0-15 cm) Taken at Test Well No. 9 | 22 |
| Figure 11 | Chromatogram of Extract From Sediment Sample Taken From Behind Lums | 25 |
| Figure 12 | Chromatogram of Fish Sample Extract from Sample Station No. 8 | 28 |
| Figure 13 | Chromatogram of Extract from Herring Gull Eggs | 29 |
| Figure 14 | Chromatogram of One-Hour Ambient Air Sample Taken at the Landfill Site | 30 |
| Figure 15 | Chromatogram of an Aroclor 1242 Standard | 31 |
| Figure 16 | Chromatogram of Air Sample Taken Upwind of Aerovox Corporation | 34 |
| Figure 17 | Chromatogram of Air Sample Taken Downwind of Aerovox Corporation | 35 |

LIST OF TABLES


| | | Page |
|---|---|---|
| Table 1 | Well Test Data | 9 |
| Table 2 | Stream Sampling Stations | 13 |
| Table 3 | Marsh Sampling Stations | 13 |
| Table 4 | Air Samples Taken June 28 through 30, 1977* | 16 |
| Table 5 | Ground Water | 17 |
| Table 6 | Soil Sample Analytical Results | 23 |
| Table 7 | Bottom Sediment Analytical Results | 23 |
| Table 8 | Analytical Results for Biota | 26 |
| Table 9 | Analytical Results for Ambient Air | 32 |

## ACKNOWLEDGEMENT

This environmental assessment was conducted in cooperation with personnel of the Environmental Protection Agency, Region I, in particular, Mr. David K. Moon, Dr. Thomas Spiller, Dr. Edward L. Taylor, and Mr. Allan Oi. The sampling program was planned with the assistance of Dr. Ian C.T. Nisbet of Clement Associates. Dr. Olin C. Braids of Geraghty & Miller, Inc., assisted with the groundwater sampling.

# SECTION 1

# INTRODUCTION

Environmental Science and Engineering, Inc. (ESE) was requested to conduct an evaluation of the transport of polychlorinated biphenyl (PCB) from a municipal landfill located in New Bedford, Massachusetts. This task was performed under Contract 68-01-3248 with the Environmental Protection Agency (EPA), Office of Toxic Substances.

The objectives of this task were to:

1. Establish if there is migration of PCB from the landfill, and if migration exists;

2. Determine the extent and degree of environmental contamination with PCB originating at the landfill;

3. Determine the mode, rate, and direction of PCB migration from the landfill; and

4. Establish a long-term groundwater monitoring program for PCB.

It was decided to approach this task in two phases. The objective of the first phase was to establish if there is migration of PCB from the landfill. This involved a one-time field survey wherein samples were collected from all media in the vicinity of the landfill that may serve as PCB transport media. An excess number of samples were taken. PCB analysis was conducted on selected samples suspected to be the most likely to be contaminated by PCB

originating at the landfill. The results of this survey are described in this report. A second phase field survey was confined to the assessment of airborne PCB levels in the vicinity of the landfill and near three other potential sources of PCB in the area. The results of the second survey are also described.

## SECTION 2

## DESCRIPTION OF THE SITE

The New Bedford municipal landfill has been the site for the disposal of reject capacitors and other wastes from two nearby capacitor manufacturing plants, Aerovox Industries, Inc., and Cornell-Dubilier Electronic Corporation. Over one-half million pounds of PCB have been disposed in this landfill over the years. PCB wastes have not been disposed of for the past two years. In the past, Aroclor® 1242 was reported to be the predominant PCB material used at these facilities. Since 1970, Aroclor 1016 has been used.

The landfill is located one-half mile from the Paskamanset River near the southern end of a large glacial lake deposit that extends from the Apponagansett Swamp to the northern limit of the Acushnet Cedar Swamp. Figure 1 shows the location of the landfill near the New Bedford Airport and Interstate 195.

This landfill has been in use for 56 years. It covers an area of 40 acres, 24 of which are filled with refuse covered with fill material. The geology of the area consists of a layer of freshwater peat varying from 7 to 10 feet thick, underlain by a thin layer of silty fine sand, and then layers of stratified silts and clayey silts with thin layers of silty clay. The sand and silt layers vary from 8 to 36 feet deep.

Groundwater, leachate, and soil samples were taken adjacent to the New Bedford municipal landfill as part of a regional PCB waste survey conducted by EPA Region I ("New England PCB Waste Management Study," EPA Region I, November, 1976). The results of the sampling effort indicated a trace (1 ug/l) of PCB in one of four shallow groundwater samples taken at the edge

Reproduced from best available copy.

## NEW BEDFORD MUNICIPAL LANDFILL AND SURROUNDINGS

* LANDFILL

FIGURE 1

of the landfill. A sample of surface leachate contained 10 ug/l of Aroclor 1016, and a surface soil sample contained 5.8 ppm Aroclor 1016 and 1.7 ppm Aroclor 1254. Other soil samples did not contain detectable levels of PCB. These results indicated that transport of PCB from the landfill may be occurring.

## SECTION 3

## FIELD SURVEY AND SAMPLING

The first field survey was conducted on June 28 through 30, 1977. The objective of this field survey was to collect samples representative of all possible modes of PCB transport from the landfill, as illustrated in Figure 2. Principal emphasis was placed on the potential for contamination of groundwater and drinking water supplies.

Samples were taken of ground water, landfill leachate, surface water, sediments, soil, air, vegetation, and aquatic and terrestrial biota in the vicinity of the landfill, Apponagansett Swamp, and the Paskamanset River. Samples taken and locations are described below.

### Ground Waters

Fourteen well points were hand-driven to various depths around the edge of the landfill at the locations shown in Figure 3, which is an aerial photograph of the landfill. Conductivity readings were taken at each of these sites. Well depth and conductivity are listed in Table 1. The conductivity studies show that at locations where two or more points were driven to different depths, the wells with the shallowest depth have the highest conductivities. This indicates that the leachate plume is shallow. Wells 3, 4, and 5 were grouped together and show this trend. Wells 7, 8, and 9 also show this same trend.

POSSIBLE AVENUES FOR PCB TO RE-ENTER THE ENVIRONMENT FROM LANDFILL DISPOSAL SITE

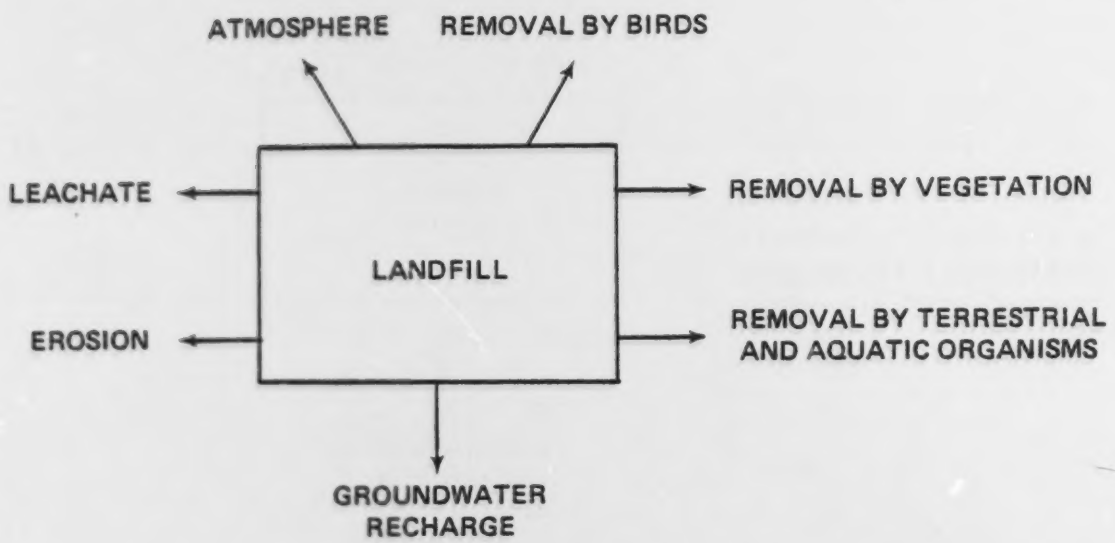



FIGURE 2

## GROUNDWATER SAMPLING POINTS

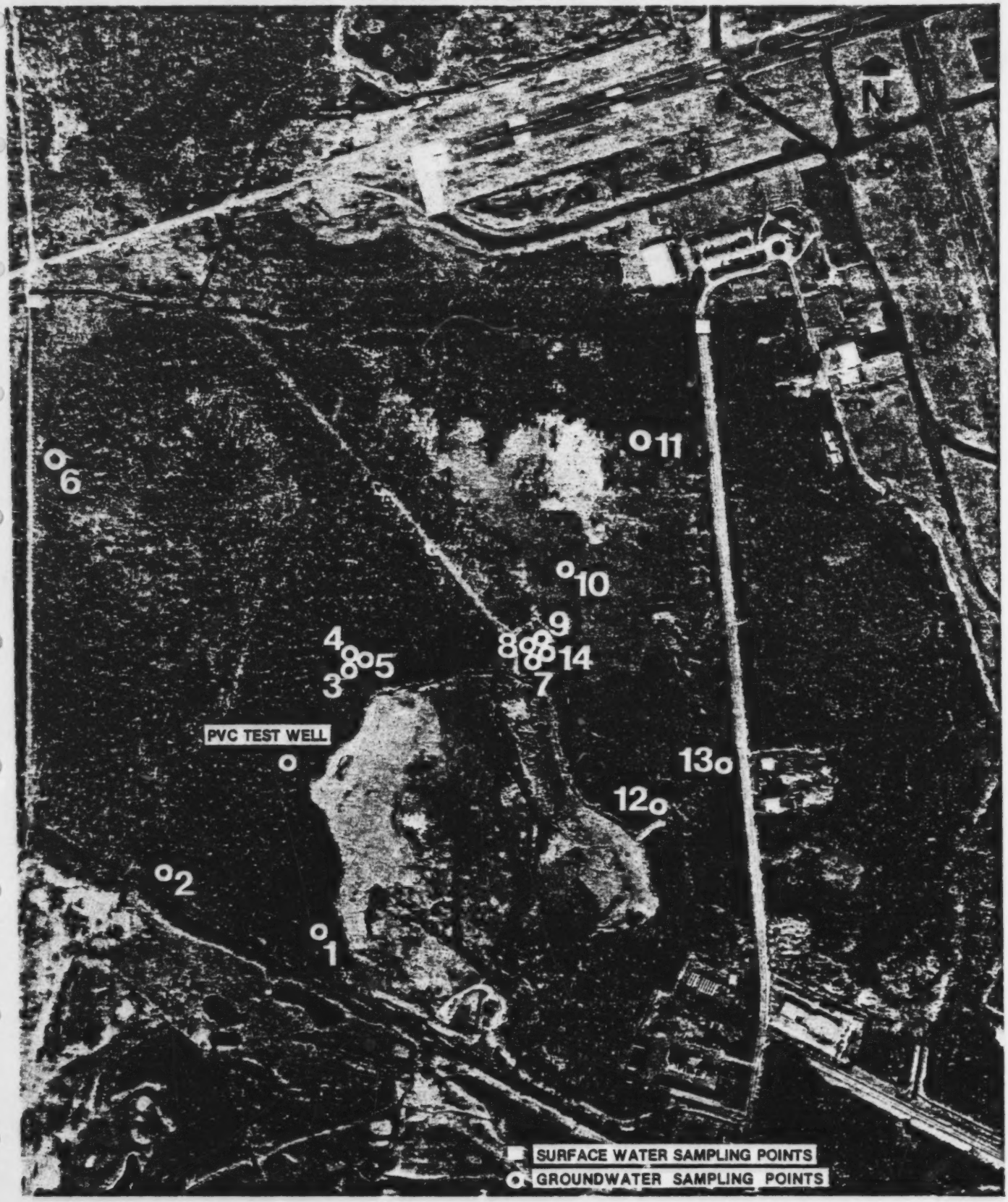



FIGURE 3

TABLE 1. WELL TEST DATA

| Well No. | Conductivity (umhos/cm) | Depth (m) | Depth (ft) | Sulfate (mg/1) | Chloride (mg/1) | Iron (mg/1) | Total Organic Carbon (mg/1) |
|---|---|---|---|---|---|---|---|
| 1 | 517 | 3.7 | 12.0 | 31 | 84 | 3.56 | 1.0 |
| 2 | 221 | 3.0 | 10.0 | | | | |
| 3 | 159 | 4.7 | 15.5 | <5 | 13 | 5.26 | 14 |
| 4 | 258 | 3.4 | 11.0 | | | | |
| 5 | 498 | 2.1 | 6.5 | | | 3.37 | |
| 6 | 234 | 1.8 | 6.0 | | | | |
| 7 | 246 | 6.4 | 21.0 | <5 | 24 | 3.14 | 16 |
| 8 | 923 | 3.5 | 11.5 | | | | |
| 9 | 1,058 | 2.1 | 6.5 | 9.2 | 149 | 7.80 | 48 |
| 10 | 394 | 3.4 | 11.0 | | | | |
| 11 | 357 | 3.2 | 10.5 | | | | |
| 12 | 1,525 | 1.8 | 6.0 | 35 | 296 | 4.88 | 2.7 |
| 13 | 301 | 1.8 | 6.0 | | | | |
| 14 | 923 | 4.9 | 16.0 | | | | |

## Soils

Difficulty was encountered in taking the soil core samples, since the terrain around the well points was too wet to sample deeper than 18 inches. Two core fractions were taken in the vicinity of Wells 7 and 9. Surface soil samples were taken at Wells 1, 3, 4, and 12.

## Drinking Water

Eighteen liters of water were collected at both Well A and Well B of the Dartmouth Municipal Water Works. In addition, a sample was taken from a private drinking water supply in the vicinity of Station 8 (see Figure 4). This residence (23 Tolland Path) has a deep artesian well (approximately 200 feet deep), and water was taken from an outside spigot for subsequent PCB analysis. These large volumes of water permitted PCB detection in the ppt (parts per trillion or nanograms per liter) level.

## Surface Water and Sediments

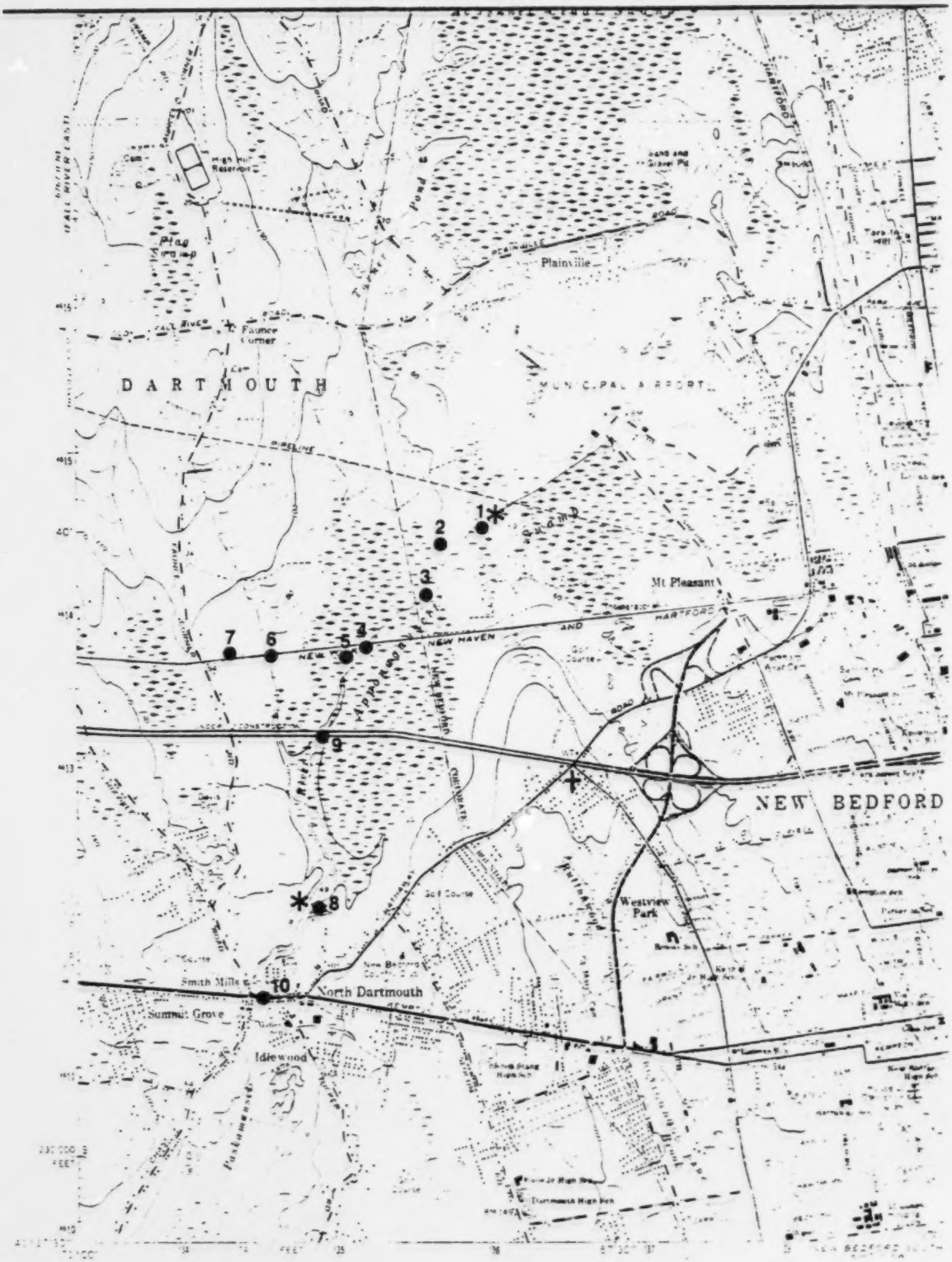
The Paskamanset River was sampled at ten different locations (see Figure 4). Conductivity and pH were determined *in situ*, and the samples listed in Table 2 were collected.

Two additional bottom sediment samples were taken from the stream, one approximately 4 miles downstream from the landfill in the vicinity of the Dartmouth Municipal Water Supply (not shown on map) and one near I-195 next to the Holiday Inn (see Figure 4).

The Apponagansett Swamp was sampled at seven different locations, as illustrated in Figure 5. Conductivity and pH were determined *in situ*, and samples were taken of water, emergent vegetation, and benthic organisms as described in Table 3. It appears from the conductivity data that if landfill leachate is entering the marsh, it is entering from the north and west sections of the landfill.

## STREAM SAMPLING STATIONS

Reproduced from best available copy.




● STREAM SAMPLING STATIONS

✱ FISH SAMPLING POINTS

+ BOTTOM SEDIMENT

FIGURE 4

## MARSH SAMPLING STATIONS

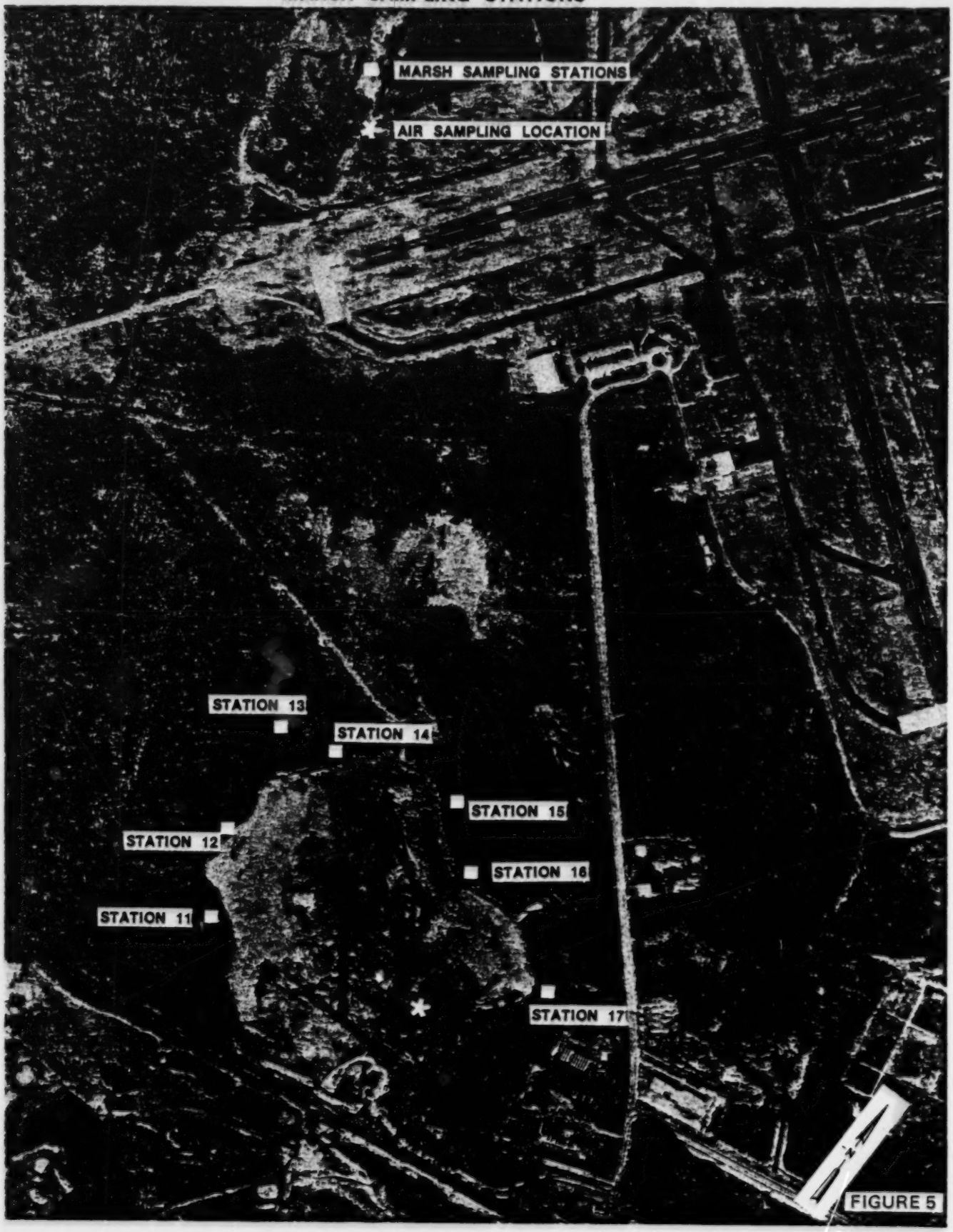



FIGURE 5

TABLE 2. STREAM SAMPLING STATIONS

| Station No. | pH | Conductivity (umhos/cm) | Benthos | Bottom Sediment | Water | Fish |
|---|---|---|---|---|---|---|
| 1 | 7.4 | 170 | X | X | X* | X |
| 2 | 5.9 | 72 | X | X | X | |
| 3 | 6.9 | 104 | X | X | X | |
| 4 | 5.5 | 68 | X | | X | |
| 5 | 5.9 | 80 | | X | X | |
| 6 | 5.3 | 38 | | X | X | |
| 7 | 6.1 | 90 | | X | X | |
| 8 | 6.3 | 89 | | X | X* | X |
| 9 | | | X | | | |
| 10 | | | X | | | |

*18-liter sample collected.

TABLE 3. MARSH SAMPLING STATIONS

| Station No. | pH | Conductivity (umhos/cm) | Benthos | Vegetation | Water |
|---|---|---|---|---|---|
| 11 | 7.2 | 524 | X | X | X |
| 12 | 7.1 | 552 | X | X | X |
| 13 | 6.9 | 2,852 | X | X | X |
| 14 | 7.2 | 1,748 | X | X | X |
| 15 | 7.1 | 2,070 | | X | X |
| 16 | 6.6 | 2,208 | | X | X |
| 17 | 7.1 | 1,380 | X | X | X |

## Vegetation

Vegetation was collected at each of the seven marsh stations as indicated in Table 3. The dominant type of vegetation was collected at each location.

## Aquatic Biota

Benthic organism samples were collected at the stream and marsh stations where noted in Tables 2 and 3. Approximately 15 fish were collected at Station 8 (Figure 4), most of which were 4 inches or less in length and of mixed varieties. Pumpkinseed (Lepomis gibbosus) was the predominant variety. Only one fish was collected at Station 1.

## Terrestrial Biota

A total of 150 snap traps was set along 5 transect lines, as shown in Figure 6. Ten trap stations 10 meters apart were situated along each transect with 3 snap traps at each station. A total of 29 organisms consisting of 2 different species of mice were collected. Six were collected from the transects along the pipeline, and the remaining 23 were collected from the transects along the golf course road. The field mice captured were of the Peromyscus sp. This species is omnivorous, eating grains, fruits, insects, and other small organisms. Life expectancy is less than one year.

Twenty eggs of the herring gull (Larus argentatus) were collected at Ram Island, Mattapoisett, Massachusetts, on June 20, 1977, by Dr. I.C.T. Nisbet. One egg was collected from each of 20 nests. Because of the late date of collection, most of the eggs had been incubated 2 to 3 weeks. Ram Island is the nearest gull colony to the New Bedford landfill (about 7 kilometers), and most, although probably not all, herring gulls from this colony feed at the landfill. They also feed on fish wastes from the port and on natural foods along the shore.

## TERRESTRIAL TRAP LOCATIONS

TERRESTRIAL TRAP LINES

N

FIGURE 6

## Air

All air samples were taken by the method of high-volume sampling at the landfill site during the period June 28 through 30, 1977. Duplicate 30-, 60-, 180-, and 360-minute samples were taken. One 15-minute sample was taken. The location of the air sampler is shown in Figure 5. Wind velocity during sampling is reported in Table 4.

TABLE 4. AIR SAMPLES TAKEN JUNE 28 THROUGH 30, 1977*

| | Wind Direction | Velocity |
|---|---|---|
| 15-minute sample | WSW | 10 to 15 mph |
| 30-minute sample | WSW | 10 mph |
| 60-minute sample | WSW | 10 mph |
| 180-minute sample | WSW | 10 to 15 mph |
| 360-minute sample | NW | 12 to 15 mph |

*Ambient temperature 26°C.

Additional air samples were taken in conjunction with EPA Region I personnel during January, 1978. Samples were taken upwind, on site, and downwind of the landfill and upwind and downwind of three other potential sources of airborne PCB in the area, including the municipal sewage sludge incinerator, Aerovox Corporation, and Cornell-Dubilier Electronics Corporation facilities. All of these samples were of 3 hours duration, comprising approximately 175 cubic meters of air. During this sampling period, the ground was frozen and a light snow cover was present. Ambient temperature was 0°C.

## SECTION 4

## ANALYTICAL RESULTS AND DISCUSSION

### Ground Waters

All shallow groundwater samples taken along the periphery of the landfill were analyzed for PCB. In addition, samples collected from Well A and Well B of the Dartmouth Municipal Water Works and the sample taken from a private artesian well (23 Tolland Path) were analyzed for PCB. These analytical results are reported in Table 5. Figure 3 shows the location of the shallow groundwater samples.

TABLE 5. GROUND WATER

| Test Well No. | Well Depth (m) | Aroclor 1016/1242 (ng/l)* | Aroclor 1254 (ng/l)* |
|---|---|---|---|
| 1 | 3.7 | <85 | <110 |
| 3 | 4.7 | <85 | <110 |
| 5 | 2.1 | <85 | <110 |
| 7 | 6.4 | 90 | 150 |
| 9 | 2.1 | 230 | 530 |
| 12 | 1.8 | <85 | <110 |
| Dartmouth Well A | --- | <3 | <1 |
| Dartmouth Well B | --- | <3 | <1 |
| Private Artesian Well | 61 | <3 | <1 |

*Parts per trillion (ppt).

Aroclor 1016/1242 and Aroclor 1254 were detected in the two shallow groundwater samples taken on the north edge of the landfill between the landfill and the Paskamanset River. All other results, including those for the artesian aquifer (drinking water), were below the respective analytical detection limits.

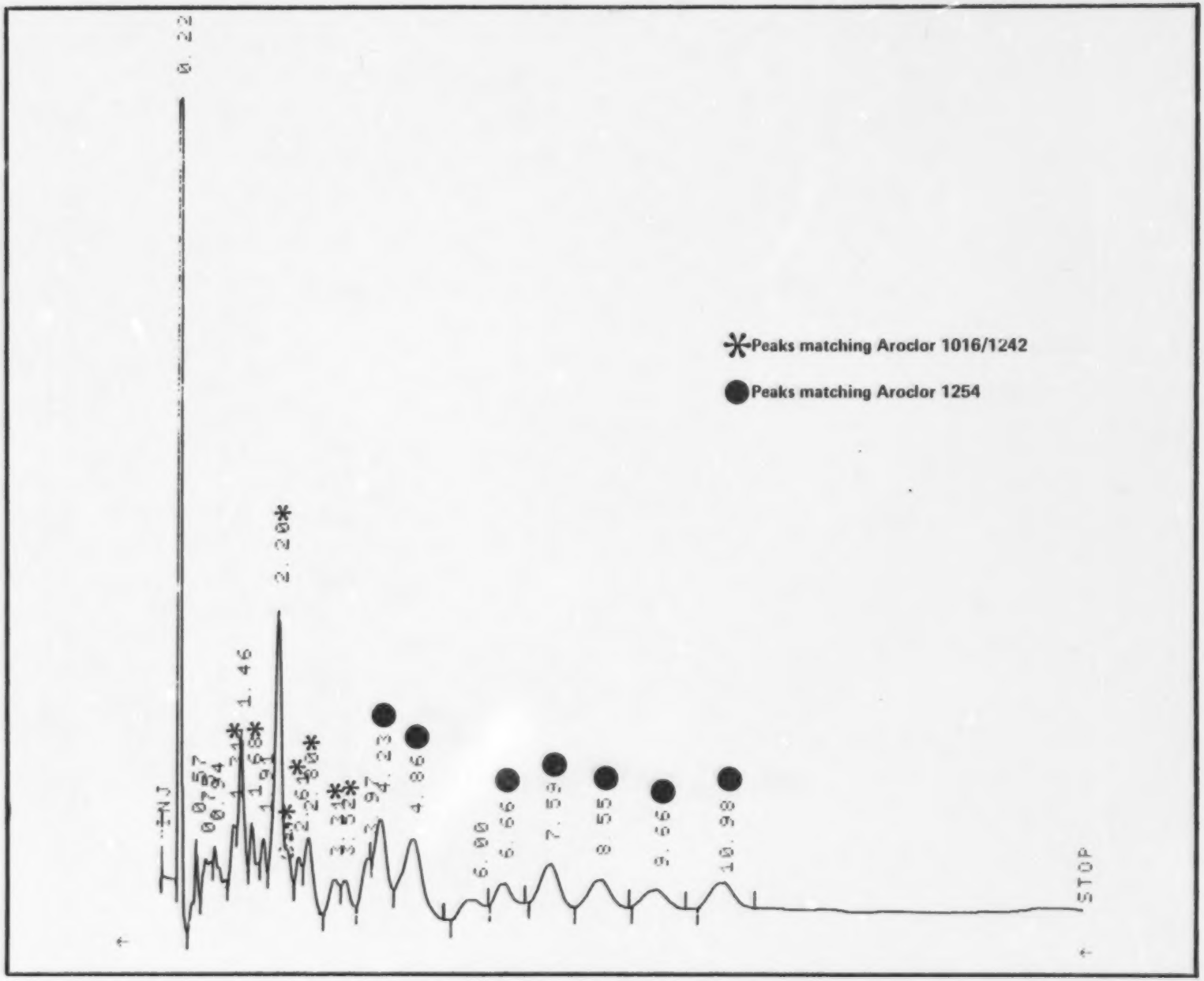
Figure 7 is a chromatogram of the water sample taken from Test Well 9. Figure 8 shows chromatograms of Aroclor 1016/1242, and Figure 9 a chromatogram of Aroclor 1254. It can be seen that the well water sample (Figure 7) contains all the major peaks of Aroclor 1254, except the two latest eluting, and many earlier peaks matching Aroclors 1016 and 1242. It is not possible when Aroclor 1254 is present to definitively identify the earlier pattern as either Aroclor 1016 or 1242, since the elution patterns for these two Aroclors differ only with respect to the last few eluting peaks which coincide with Aroclor 1254 peaks.

The groundwater analytical results indicate no artesian aquifer (drinking water) contamination with PCB. There is PCB contamination of the shallow ground water to the immediate north of the landfill. This contamination consists of Aroclor 1016/1242 and Aroclor 1254, and seems to be highest toward the surface with decreasing concentrations with depth. The maximum PCB concentration measured was 0.76 ug/1. There is no apparent correlation of PCB concentration to conductivity or any of the other parameters (Fe, TOC, $SO_4^{=}$, $Cl^{-}$) measured in the shallow ground waters. PCB does not appear in shallow ground waters to the west, northwest, and east of the landfill.

Soil Borings

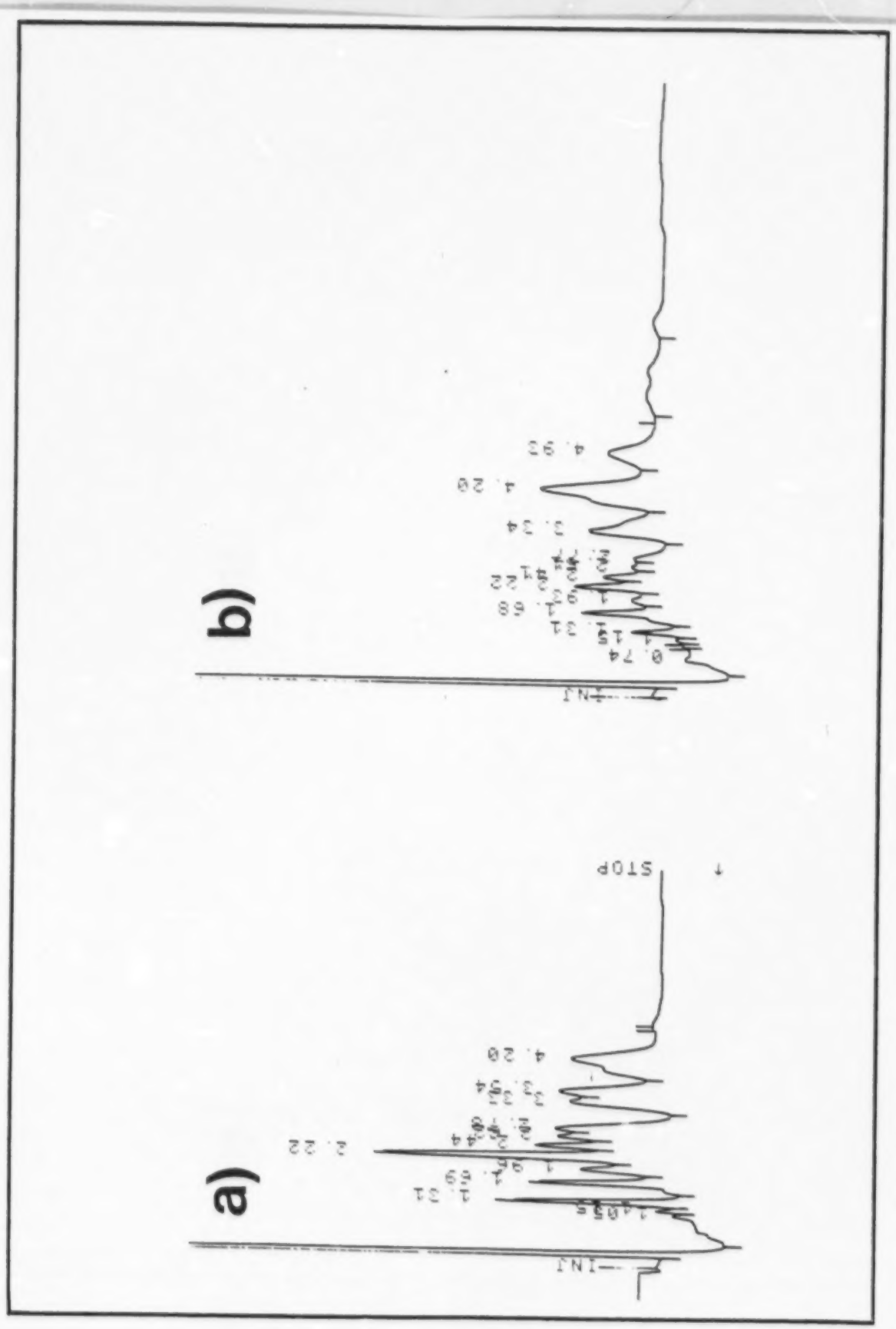
Soil core samples taken at Test Well 9 were analyzed in two sections. The results are shown in Table 6 along with a surface soil sample taken near Test Well 3. Figure 10 is the chromatogram of the 0- to 15-cm core at Test Well 9 showing that both Aroclor 1016/1242 and Aroclor 1254 are present.

The decreasing PCB concentration with core depth agrees with the same observation for the water taken from Test Wells 7 and 9. In these soil




**CHROMATOGRAM OF SHALLOW GROUNDWATER SAMPLE FROM TEST WELL NO. 9**

FIGURE 7




CHROMATOGRAM OF a) AROCLOR 1016 STANDARD AND b) AROCLOR 1242 STANDARD

FIGURE 8

CHROMATOGRAM OF AROCLOR 1254 STANDARD

FIGURE 9

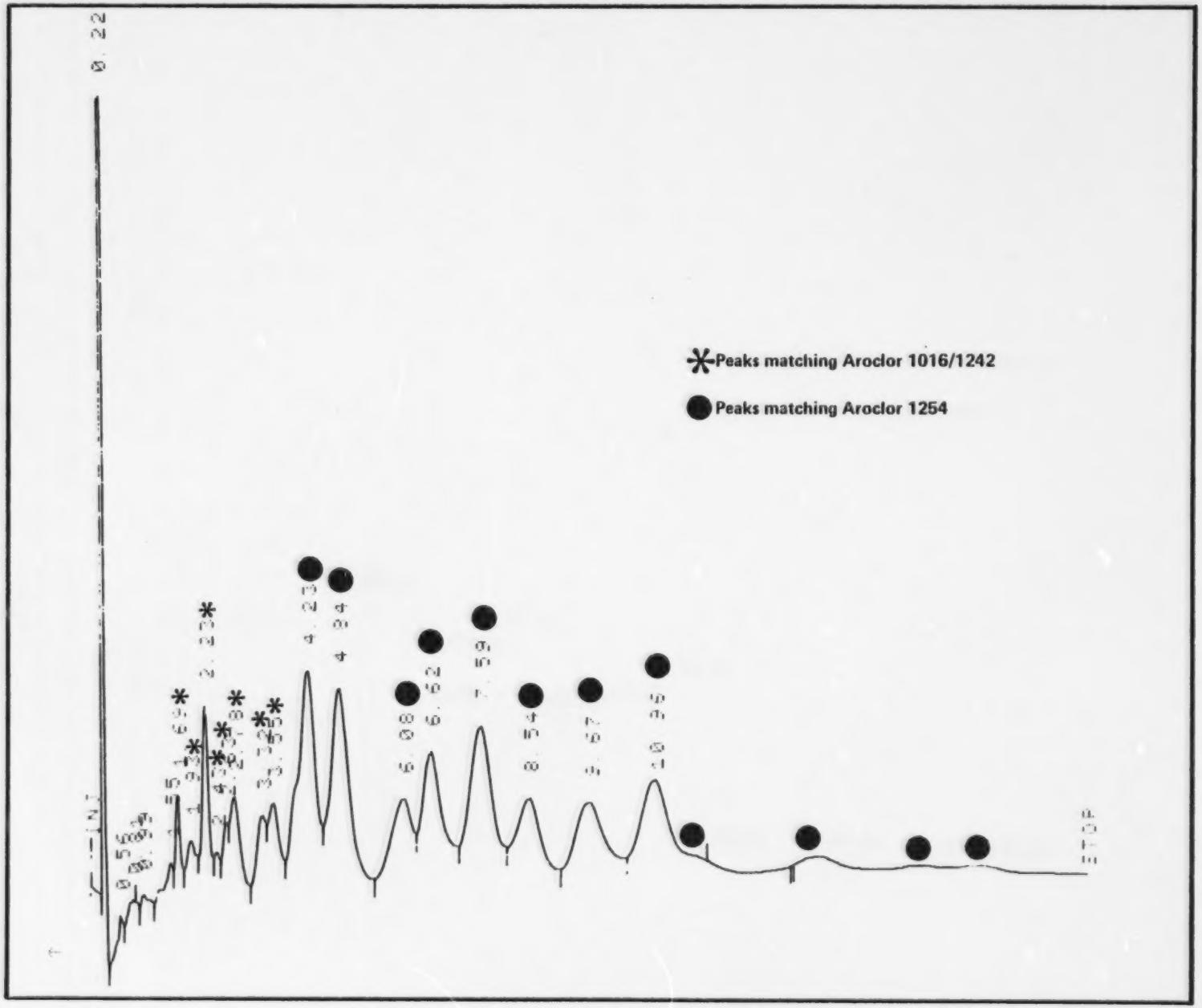



FIGURE 10

CHROMATOGRAM OF SOIL CORE (0-15 cm)
TAKEN AT TEST WELL NO. 9

TABLE 6. SOIL SAMPLE ANALYTICAL RESULTS

| | Aroclor 1016/1242 (ppb) | Aroclor 1254 (ppb) |
|---|---|---|
| Core at Test Well 9 (0 to 15 cm) | 32 | 183 |
| Core at Test Well 9 (15 to 30 cm) | <7 | 27 |
| Surface Sample near Test Well 3 | 97 | 343 |

TABLE 7. BOTTOM SEDIMENT ANALYTICAL RESULTS

| | Aroclor 1016/1242 (ppb) | Aroclor 1254 (ppb) |
|---|---|---|
| Station 1 | 30 | 230 |
| Station 3 | <5 | 34 |
| Station 5 | <5 | 170 |
| Station 8 | <5 | <10 |
| Behind Lums | 8 | 280 |

samples, Aroclor 1254 comprises approximately 82 percent of the total PCB present, while for the shallow ground water it comprised approximately 66 percent of the total PCB.

Stream Sediments

Bottom sediment samples were taken along the Paskamanset River at the locations shown in Figure 4. A sample of sediment was also taken from the stream passing through the property in the vicinity of Interstate 195 and the Holiday Inn (behind Lums), which is reported (Mr. Daniel K. Moon, personal communication, EPA Region I) to have been a previous PCB disposal site. The sediment samples listed in Table 7 were selected for analysis.

Figure 11 is the chromatogram of the extract from the bottom sediment sample taken from the stream behind Lums. This chromatogram shows a total of 288 ppb PCB, 98 percent of which is Aroclor 1254.

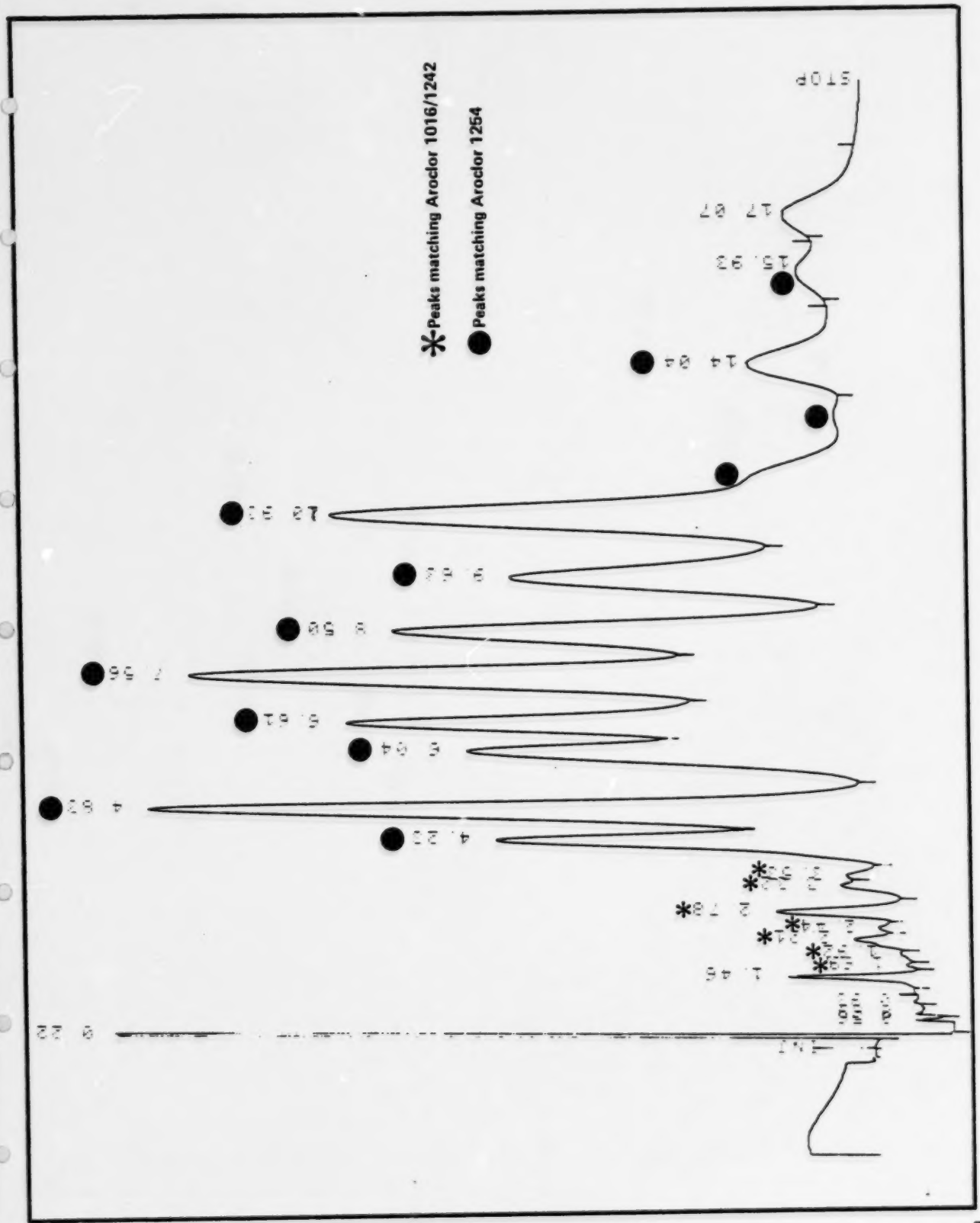
PCB, consisting of predominately Aroclor 1254 with lesser amounts of Aroclor 1016/1242, is present in stream sediments along the Paskamanset River north of Interstate 195. South of Interstate 195, PCB was not detected in bottom sediments.

Surface Water

The surface water sample from Sample Station 8 (Figure 4) was analyzed for PCB. The remaining surface water samples are being held pending a decision on further analyses. The surface water at Sample Station 8 did not contain detectable levels of PCB. Aroclor 1016/1242 was less than 0.08 ug/l (ppb), and Aroclor 1254 was less than 0.10 ug/l.

Biota

Analysis was conducted of a composite sample of benthic organisms taken from Apponagansett Swamp (Figure 5) along the periphery of the landfill and a second composite sample of benthic organisms taken from the Paskamanset River




CHROMATOGRAM OF EXTRACT FROM SEDIMENT SAMPLE TAKEN FROM BEHIND LUMS

FIGURE 11

north of Interstate 195 (Figure 4) at a distance of 1.6 to 2.0 km from the landfill. Fish samples taken at Sample Stations 1 and 8 (Figure 4) were also analyzed. The fish sample at Station 1 represents a single fish captured at that location, while the sample at Station 8 is a composite of 15 fish of mixed variety, principally Pumpkinseed (Lepomis gibbosus), all approximately 10 cm in length.

Twenty eggs of the herring gull (Larus argentatus) were collected at Ram Island, Mattapoisett, Massachusetts, on June 20, 1977, by Dr. I.C.T. Nisbet. Ten of those eggs were composited for analysis of PCB. Field mice (Peromyscus sp.) were analyzed on a whole-body basis after removal of fur and skin.

The analytical results for all the biota are summarized in Table 8. Benthic organisms in the marsh adjacent to the landfill contained a total PCB concentration of 2.53 ppm, of which 82 percent is Aroclor 1254. In the stream passing through the marsh at a distance of approximately 1.6 km from the landfill, benthic organisms had a total PCB concentration of 1.35 ppm, of which 84 percent is Aroclor 1254.

TABLE 8. ANALYTICAL RESULTS FOR BIOTA

| | Aroclor 1016/1242 (ppb)* | Aroclor 1254 (ppb)* |
|---|---|---|
| Benthos | | |
| Marsh Sample Composite | 460 | 2,070 |
| Stream Sample Composite | 220 | 1,130 |
| Fish | | |
| Sample Station 1 | <10 | 360 |
| Sample Station 8 | <10 | 330 |
| Herring Gull Eggs | | |
| Ram Island Colony | 76 | 4,600 |
| Terrestrial Organisms | | |
| Field Mice (Peromyscus sp.) | | |
| Trap Line #1 | <10 | 11 |
| Trap Line #2 | <10 | 18 |

*Wet weight basis.

The fish samples contained only traces of Aroclor 1016/1242, but larger quantities of Aroclor 1254 (average 345 ppb). Figure 12 shows the chromatogram of the fish sample taken at Sample Station 8. It should be recalled that PCB was not detected in either the water or bottom sediment at this location.

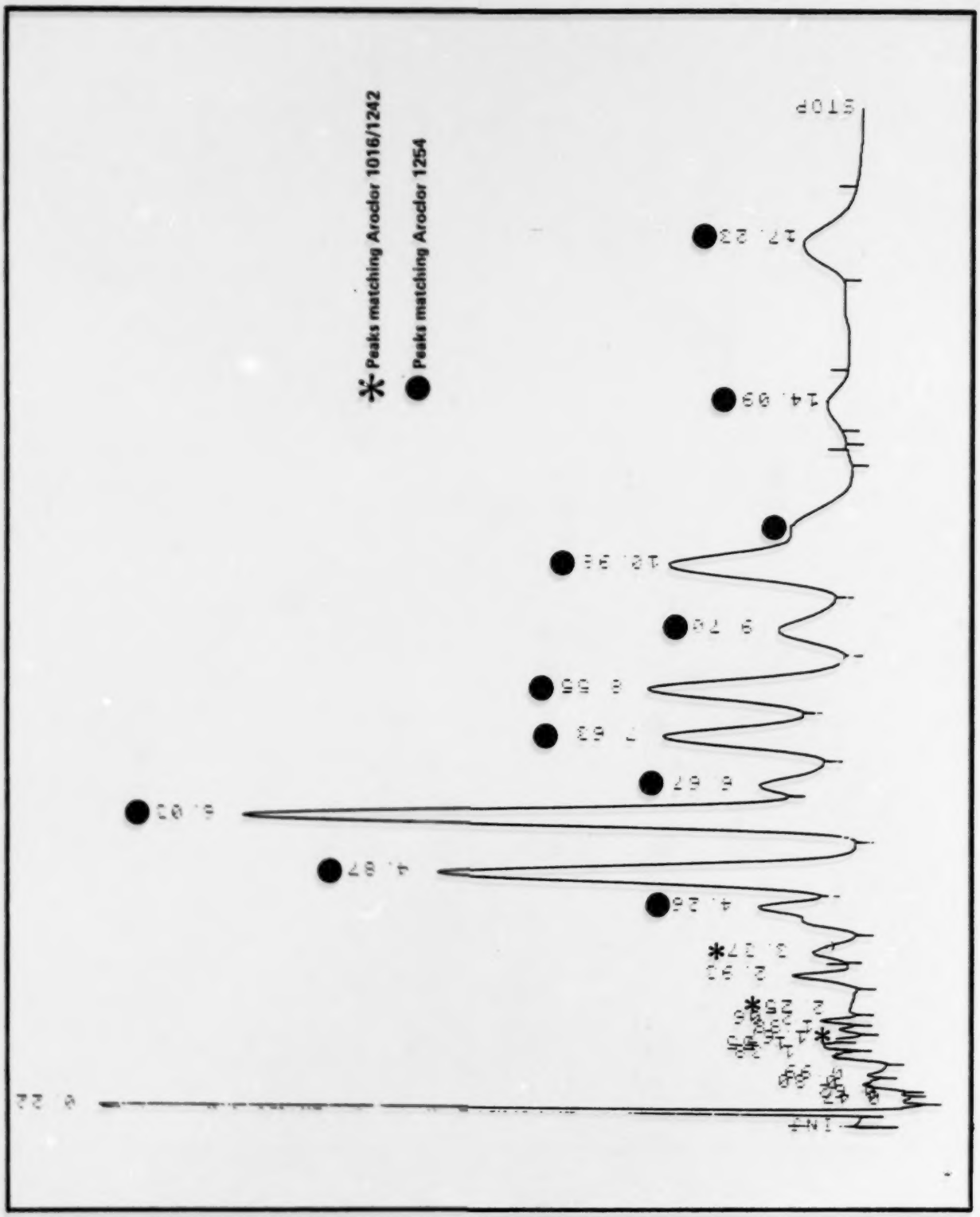
The herring gull eggs contained substantial quantities (4.6 ppm) of Aroclor 1254, and lesser quantities (0.076 ppm) of Aroclor 1016/1242. Figure 13 is a chromatogram of the egg extract. The field mice contained an average of 16 ppb of Aroclor 1254, while Aroclor 1016/1242 was not detected in these organisms.

Ambient Air

Ambient air samples taken June 28 and June 30, 1977, over the landfill were analyzed for PCB. These samples were located on the landfill, as illustrated in Figure 5. The samplers were located about 2 meters above ground level. Additional air samples were taken in the area in January, 1978. All air analyses are reported in Table 9.

On June 28, 1977, airborne PCB concentration over the landfill averaged 1.19 ug/$m^3$. These samples were taken from 11:00 a.m. to noon while wind velocity was west-southwest at approximately 10 mph. A sample taken on June 30, 1977, yielded a concentration of 0.41 ug/$m^3$ when winds were from the northwest at 12 to 15 mph. As may be seen by comparison of the chromatogram of one of these air sample extracts (Figure 14) with the chromatogram of Aroclor 1242 standard (Figure 15), the pattern match is very good. Aroclor 1242 is clearly present in these air samples. The presence of PCB in these samples was confirmed by perchlorination. Further analysis indicated that the non-chlorinated species, biphenyl, was not present.

Ambient air samples were taken in January, 1978, upwind, on site, and downwind of the landfill, and upwind and downwind of three other possible sources in the area. The analytical results for these samples are also shown in Table 9. At the time of sampling, the ground was frozen and a light snow




CHROMATOGRAM OF FISH SAMPLE EXTRACT
FROM SAMPLE STATION NO. 8

FIGURE 12

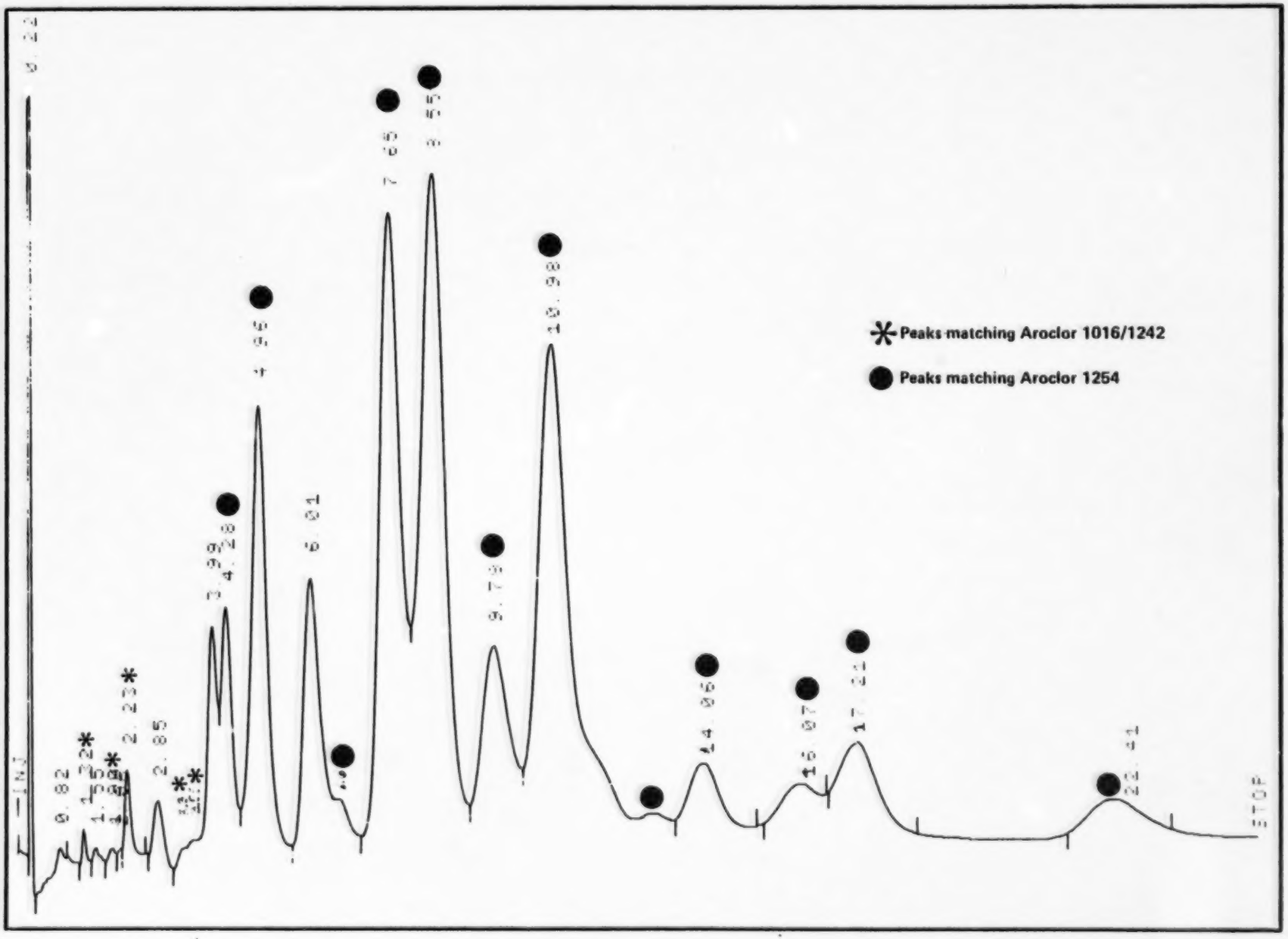
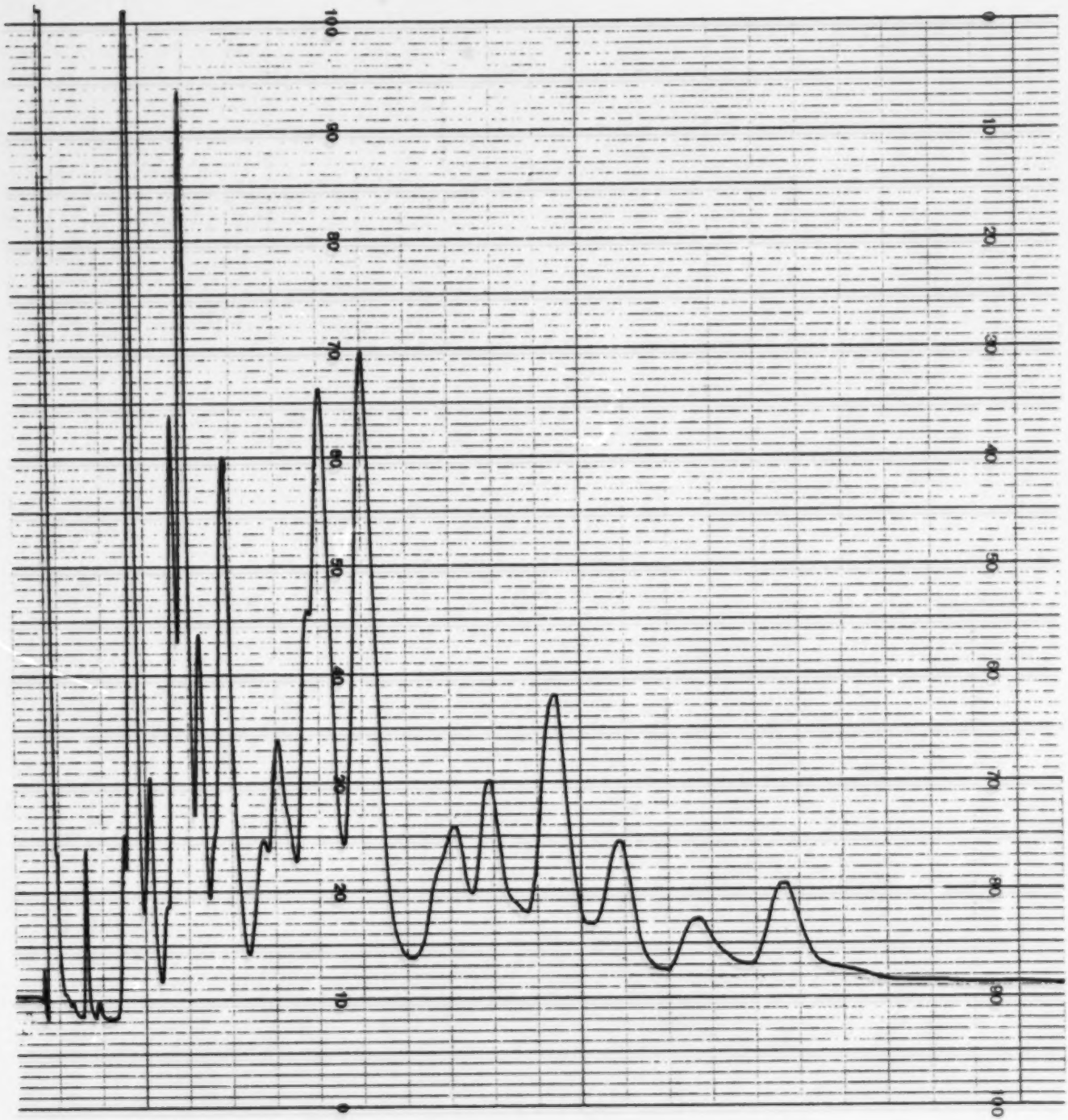


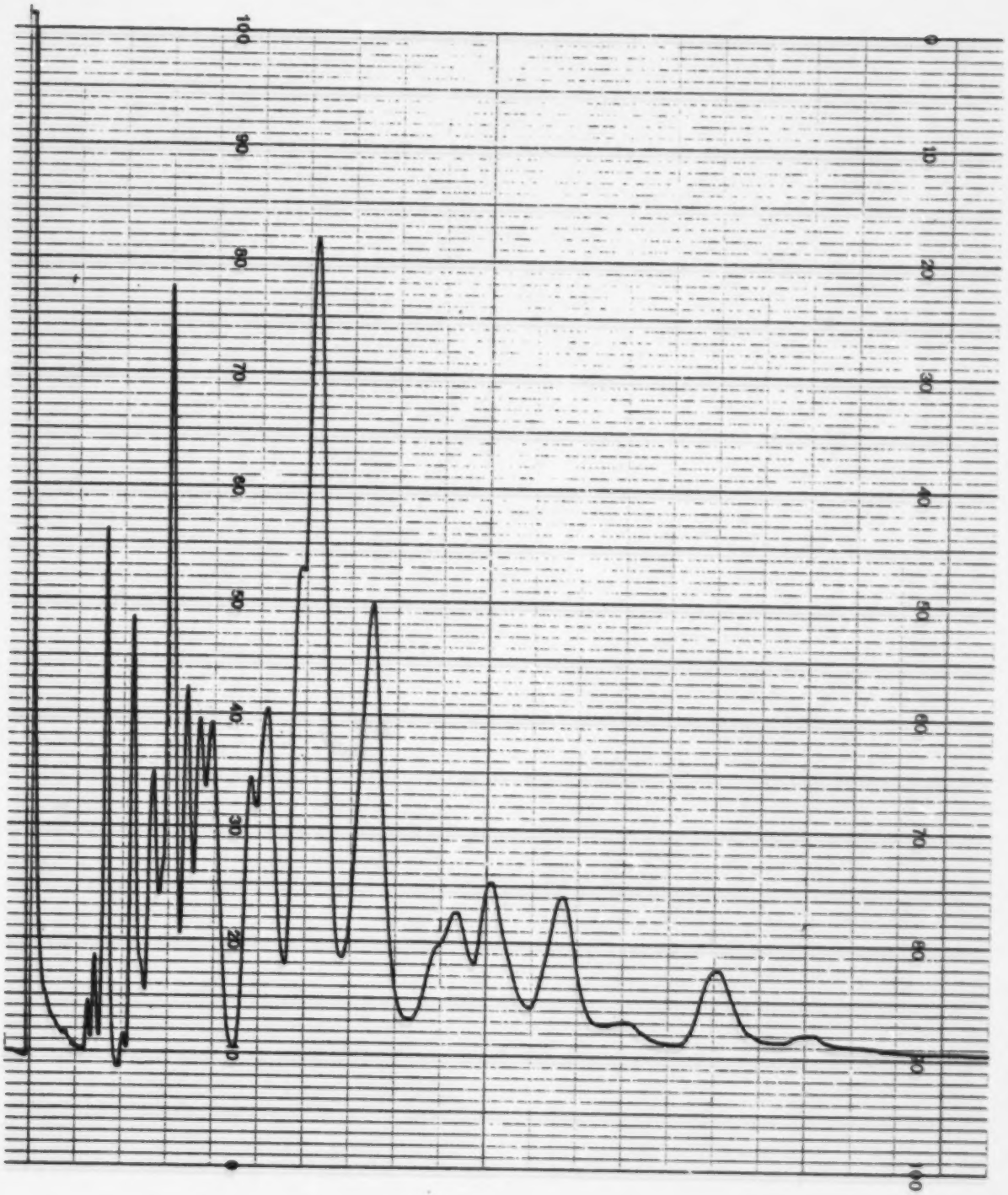

FIGURE 13

CHROMATOGRAM OF EXTRACT
FROM HERRING GULL EGGS



CHROMATOGRAM OF ONE-HOUR AMBIENT AIR SAMPLE
TAKEN AT THE LANDFILL SITE

FIGURE 14



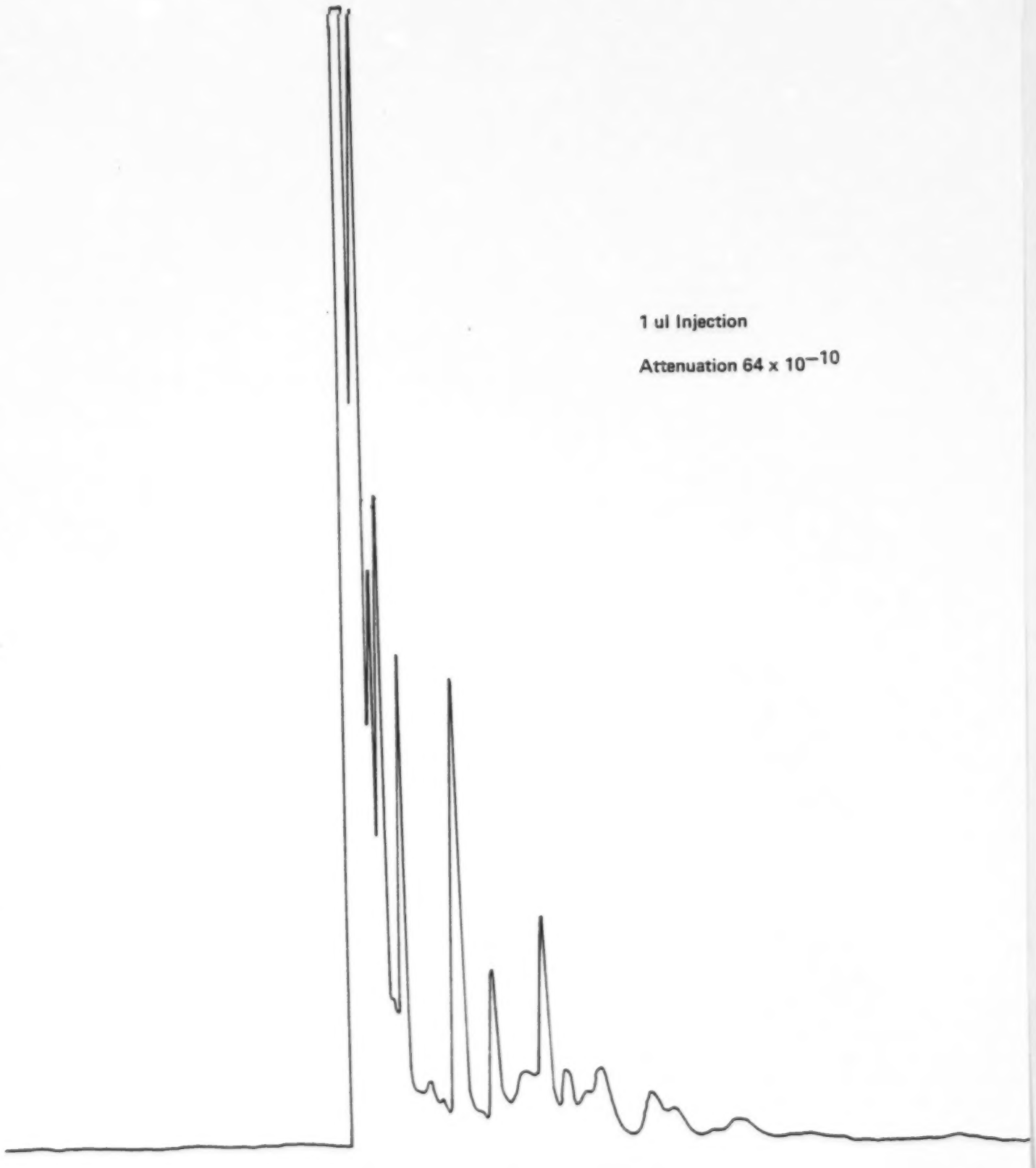

CHROMATOGRAM OF AN AROCLOR 1242 STANDARD

FIGURE 15

TABLE 9. ANALYTICAL RESULTS FOR AMBIENT AIR

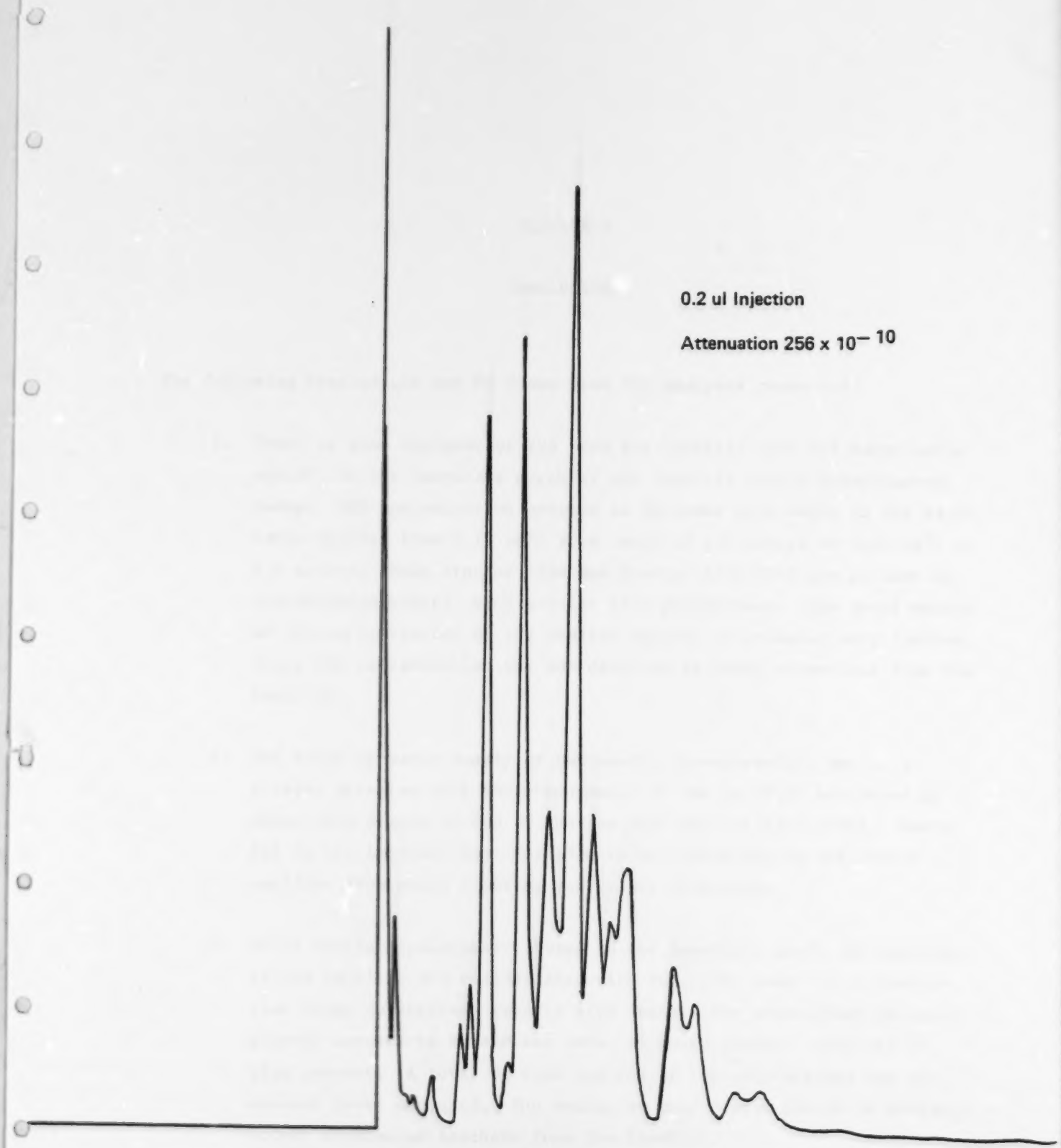
| Sample Date | Site | Location | PCB Concentration ($ug/m^3$) | Aroclor |
|---|---|---|---|---|
| 6/28/77 | landfill | on site | 0.89 | 1242/1016 |
| | landfill | on site | 1.5 | 1242/1016 |
| 6/30/77 | landfill | on site | 0.41 | 1242/1016 |
| 1/17/78 | landfill | upwind | 0.0085 | 1242/1016 |
| | | on site | 0.021 | 1242/1016 |
| | | downwind | 0.013 | 1242/1016 |
| 1/24/78 | sludge incinerator | upwind | 0.0043 | 1242/1016 |
| | | downwind | 0.013 | 1242/1016 |
| 1/27/78 | Aerovox Corp. | upwind | 0.0056 | 1242/1016 |
| | | downwind | 0.49 | 1016 only |
| 1/19/78 | Cornell-Dubilier | upwind | 0.019 | 1242/1016 |
| | | downwind | 0.0051 | 1242/1016 |

cover was present. A light snowfall was also occurring. The data show an increased airborne PCB concentration downwind of the New Bedford municipal sewage sludge incinerator, the landfill, and Aerovox Corporation facilities. Ambient levels over the landfill were substantially lower than during the summertime sampling. All samples but one indicated the presence of Aroclor 1016 and traces of Aroclor 1242. Downwind of the Aerovox Corporation, only Aroclor 1016 was detected. Figures 16 and 17 show the chromatograms of the upwind and downwind sample extracts, respectively, taken in the vicinity of the Aerovox Corporation. Note in these figures that the downwind sample is shown at a recorder attenuation twenty times greater than the upwind sample.




CHROMATOGRAM OF AIR SAMPLE
TAKEN UPWIND OF AEROVOX CORPORATION

FIGURE 16




CHROMATOGRAM OF AIR SAMPLE
TAKEN DOWNWIND OF AEROVOX CORPORATION

FIGURE 17

## SECTION 5

## CONCLUSIONS

The following conclusions may be drawn from the analyses conducted:

1. There is some movement of PCB from the landfill into the water table aquifer to the immediate north of the landfill within Apponagansett Swamp. PCB contamination appears to decrease with depth in the water table aquifer from 0.76 ug/l at a depth of 2.1 meters to 0.24 ug/l at 6.4 meters. Both Aroclor 1254 and Aroclor 1016/1242 are present in contaminated waters, with Aroclor 1254 predominant. The areal extent of the contamination of the shallow aquifer is probably very limited, since PCB contamination was not detected in other directions from the landfill.

2. The drinking water supply of Dartmouth, Massachusetts, and of a private artesian well south-southwest of the landfill contained no detectable traces of PCB at the few part per trillion level. Hence, PCB in the landfill does not seem to be contaminating the deeper aquifers from which drinking waters are withdrawn.

3. Soils within Apponagansett Swamp to the immediate north and northwest of the landfill are contaminated with PCB. The level of contamination seems to decrease rapidly with depth. The predominant material present appears to be Aroclor 1254, although Aroclor 1016/1242 is also present. A total of 0.44 ppm PCB at the soil surface was the maximum level measured. The source of this contamination is probably either erosion or leachate from the landfill.

4. Benthic organisms in Apponagansett Swamp along the periphery of the landfill and within the Paskamanset River are contaminated with PCB. The level of contamination is higher in the benthic organisms taken near the landfill (2.5 ppm) than those taken from the stream (1.4 ppm). These organisms probably accumulate the PCB by ingestion of contaminated soils and detrital particles.

5. Field mice captured in the swamp contain residual PCB levels of 0.016 ppm. This has probably accumulated as a result of the consumption of contaminated animal and vegetable matter. Levels are not high enough to indicate extensive bioaccumulation in these short-lived animals.

6. Bottom sediments along the Paskamanset River exhibit some PCB contamination, but only to the north of Interstate 195. The transport of PCB downstream is limited in distance to a reach of approximately 2.5 km.

7. Fish captured in the stream contained an average of 0.34 ppm PCB. Fish probably accumulate PCB by eating contaminated organisms. The fish captured were not of edible size; however, levels of contamination were considerably below the Food and Drug Administration action limit of 5 ppm for edible fish.

8. Herring gull eggs taken from the Ram Island colony contained substantial quantities of PCB (4.6 ppm), predominantly in the form of Aroclor 1254. Many of these gulls feed at the landfill; however, they also feed on fish and other organisms in the area which may contain PCB. Previous analysis of fish taken from New Bedford Harbor indicated substantial levels of PCB contamination (up to 290 ppm in an American eel). Hence, it is not possible to unequivocally identify the herring gull as a major mode of PCB transport from the landfill.

9. During the summer, airborne PCB levels at the landfill were in excess of 1.0 ug/$m^3$. These levels must be considered relatively high since they exceed the maximum permissible 8-hour exposure level for industrial workers (OSHA, 1977). Samples taken at the same location during the winter when the ground was frozen indicate that ambient air levels of PCB over the landfill are substantially lower than during the summer (0.02 ug/$m^3$). There is some evidence of low-level airborne emissions of PCB from the landfill even during the winter however.

10. Results of the air samples taken in January, 1978, indicate that the municipal sewage sludge incinerator is a low-level PCB emitter, while Aerovox Corporation appears to substantially increase downwind ambient levels of PCB. Cornell-Dubilier Electronics Corporation had no detectable emissions at the time of sampling.

The results of this survey indicate there is migration of PCB from the New Bedford landfill. Although PCB has migrated to shallow ground waters immediately adjacent to the landfill, the extent of groundwater contamination appears to be restricted to a very limited area. Transport of PCB in the ground water is probably limited by the high absorption capacity of the peaty soils in the area plus the likelihood the landfill is located on a groundwater discharge area rather than a recharge area.

PCBs have migrated from the landfill into the surface water and biological systems of Apponagansett Swamp. Soils, sediments, and benthic organisms in the swamp are contaminated with PCB. This contamination appears to be limited to the area north of I-195. Again, highly-absorptive, peaty soils probably limit physical transport of PCB. Bioaccumulation of PCB is demonstrated by the relatively high levels detected in benthic organisms within the swamp. Transport of this contamination up the food chain to the more mobile biological organisms (i.e., fish) is occurring. Herring gulls may be accumulating substantial levels of PCB contamination in their eggs as a result of their feeding at the landfill.

Ambient air analysis indicates volatilization is a likely and possibly principal mode of transport of PCB from the landfill. There is insufficient data to determine the rate of this transport; however, it is substantially greater during the summer than during the winter, as may be expected since ambient temperatures are higher.